

Pilot Challenge Subproject

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Overview

The NIH is exploring the concept of “Pilot” and “Grand Challenges” as a cost-effective means to engage the research community to address a common goal. The long-term goal is to set up an informatics and cloud-based infrastructure to store data sets from each research domain and host a competition. Members of the national and international community can compete on applying their user-developed software packages to achieve a defined performance level for decision support. The relative performance of these software tools would be compared and a series of prizes awarded for the top performers. The experience gained by the research teams that participate in these challenges will help them to be more competitive in later seeking R01 research funding in informatics and decision support systems.

An excellent model for “Grand Challenges” is a comparative evaluation of research or clinical decision support systems, where the driving research goal will address either predicting and/or measuring the response to therapy. The latter goal is very consistent with NCI interest in precision medicine and the implementation of adaptive therapy trials.

High-Level Goals

The overarching goal of this project is to demonstrate the feasibility for establishing an informatics and IT infrastructure to implement pilot challenges for Clinical and Pre-clinical studies integrating three domains: Genomics, Diagnostic Imaging, and Digital Pathology. The intent is to identify and address the interoperability needs to support specific research objectives, with the goal of demonstrating the need to scale up.

The scope is limited to pilot data sets, and thus the intent is only to demonstrate the infrastructure, not to robustly demonstrate the performance of software tools or robust correlation of imaging features with genomics signatures. The latter research scope will be scaled up and supported by other extramural support using the informatics and IT infrastructure after completion of the pilot.

Infrastructure will be put in place, with demonstration scientific applications (specific scientific use cases) as part of the challenges. Additional scientific work will be done over time as the infrastructure is scaled up.

The three pilot challenges will focus on the research goals below:

- Provide a means to compare the relative performance of selected imaging feature(s) extracted from the images, namely one or more feature as required for decision making, using a single cancer type (GBM's) as a model, and one molecular and/ or anatomical imaging modality.

An example of image features for clinical or preclinical imaging may include spatial features such as segmented volumes, image texture, *etc.*, or other functional or molecular (probe) based related parameters, such as contrast dynamics or uptake within the targeted tumor site. For digital pathology, the features may include cell density or shape, *e.g.*

- For each research domain explore a means for correlation of the selected imaging feature(s) with the best performance, with genomics signatures, or other molecular-based data, with the goal of predicting and/or measurement of response to drug or radiation therapy. Determining the relative performance of features will require some level of annotation of images or ground truth.

Access to existing retrospective databases is proposed for each research domain to avoid the cost of data collection. However, more comprehensive databases and levels of annotation will be required to extend this work in future to evaluate the performance of clinical decision tools. The goals of this project are thus limited to creating a proof-of-concept that explores and demonstrates the informatics and IT infrastructure that can support future efforts to create clinical decision support systems under other sources of extramural funding.

Subproject Team

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Karl Helmer	Project Manager	MGH
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Subproject Documentation

Background Documents

- [2012 - 2013 Multi-modal Brain Tumor Segmentation Challenge Overview](#)
- [2014 Medical Image Computing and Computer Assisted Intervention \(MICCAI\) Challenge Proposal](#)
- [2014 MICCAI BRATS Proposal](#)
- [Presentation to TCGA Glioma Research Group by Rafel Meier, University of Bern, on Multi-modal Brain Tumor Segmentation](#)
- [Consolidate Radiology and Pathology proposal to MICCAI](#)

Project Documents

- [Scope](#)
- [Requirements](#)
- [Monthly Status Reports](#)
- [Weekly Status Reports](#)